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APR 04 2006
PATENT & TRADEMARK OFFICE

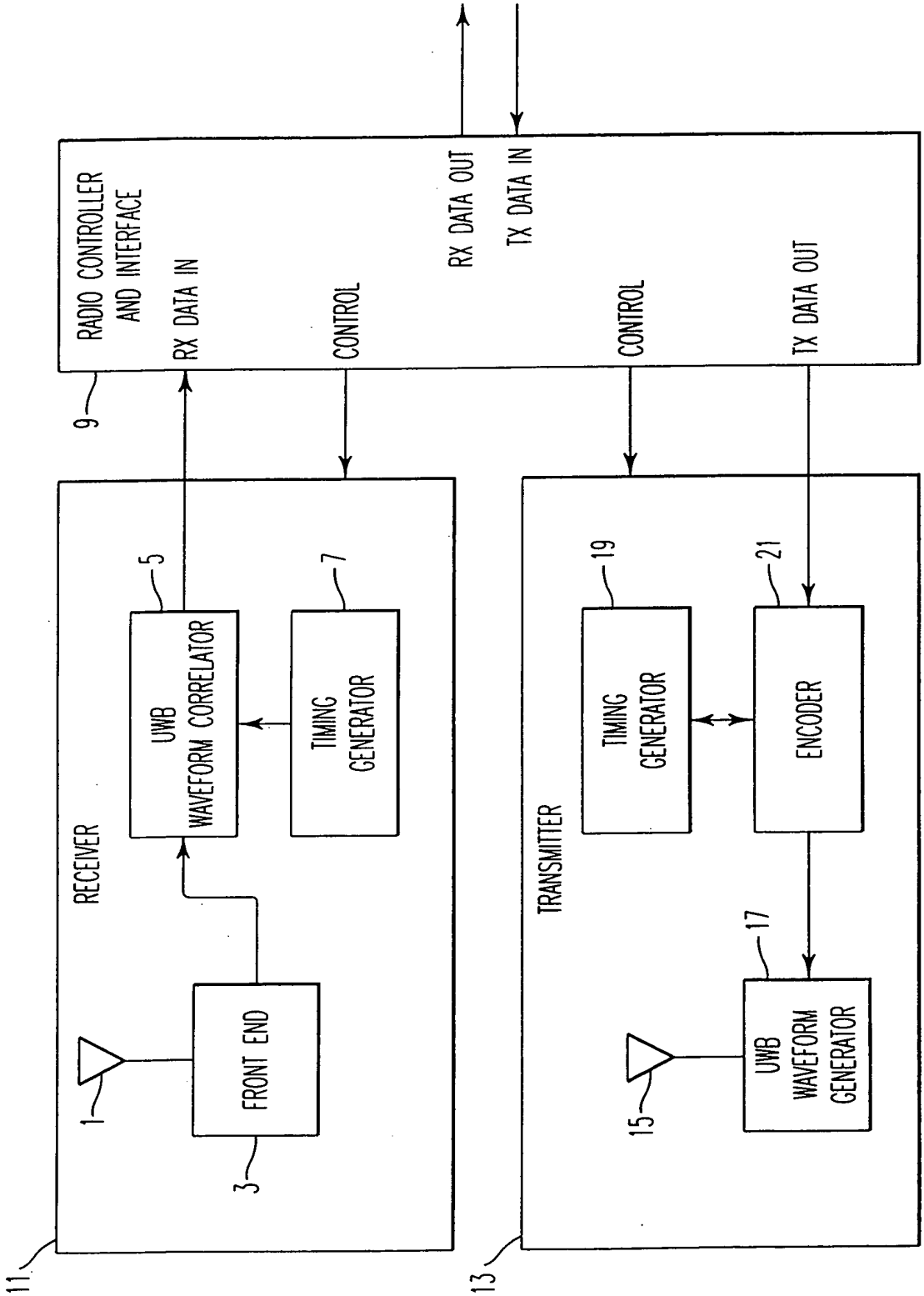


FIG. 1A

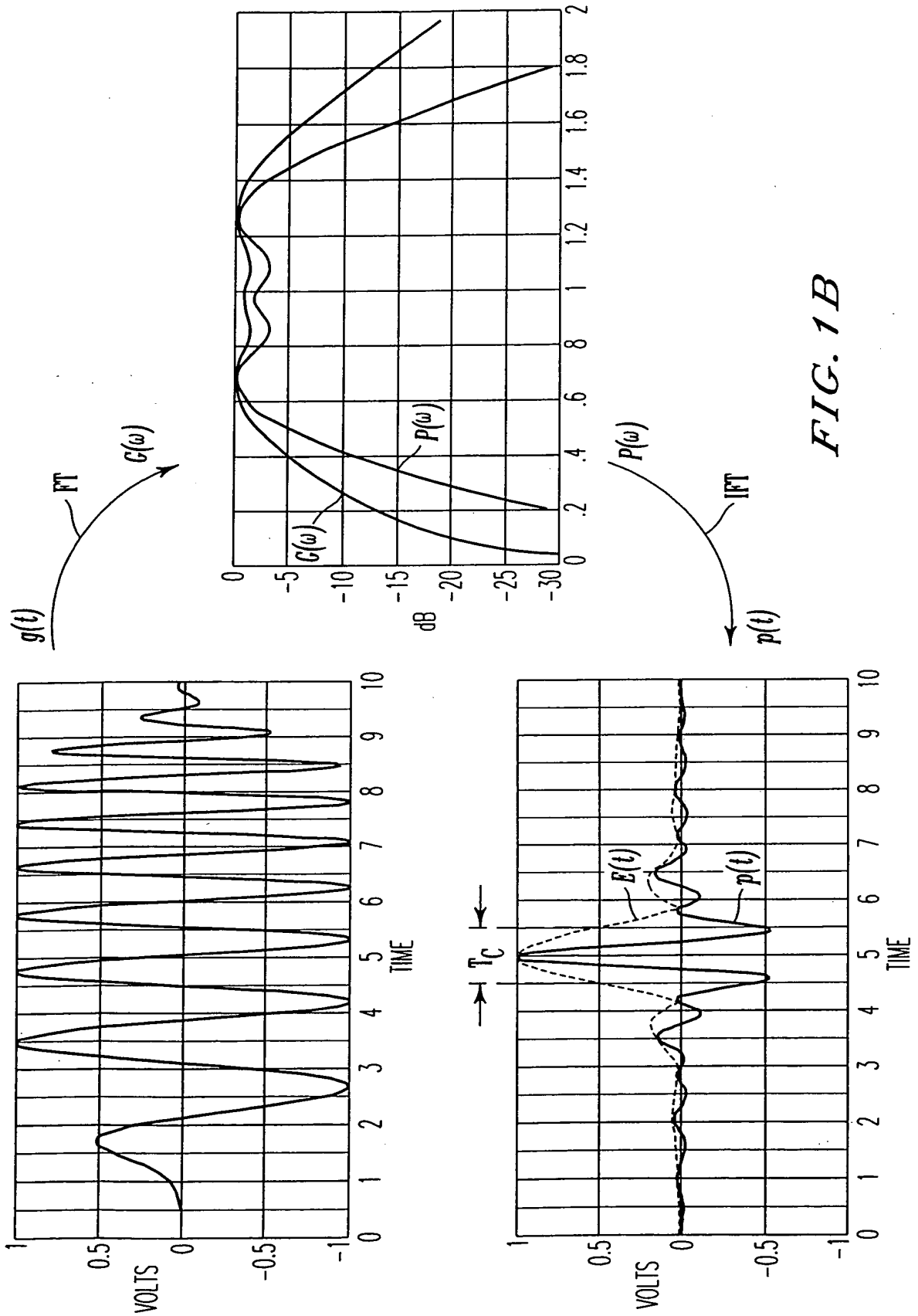


FIG. 1B

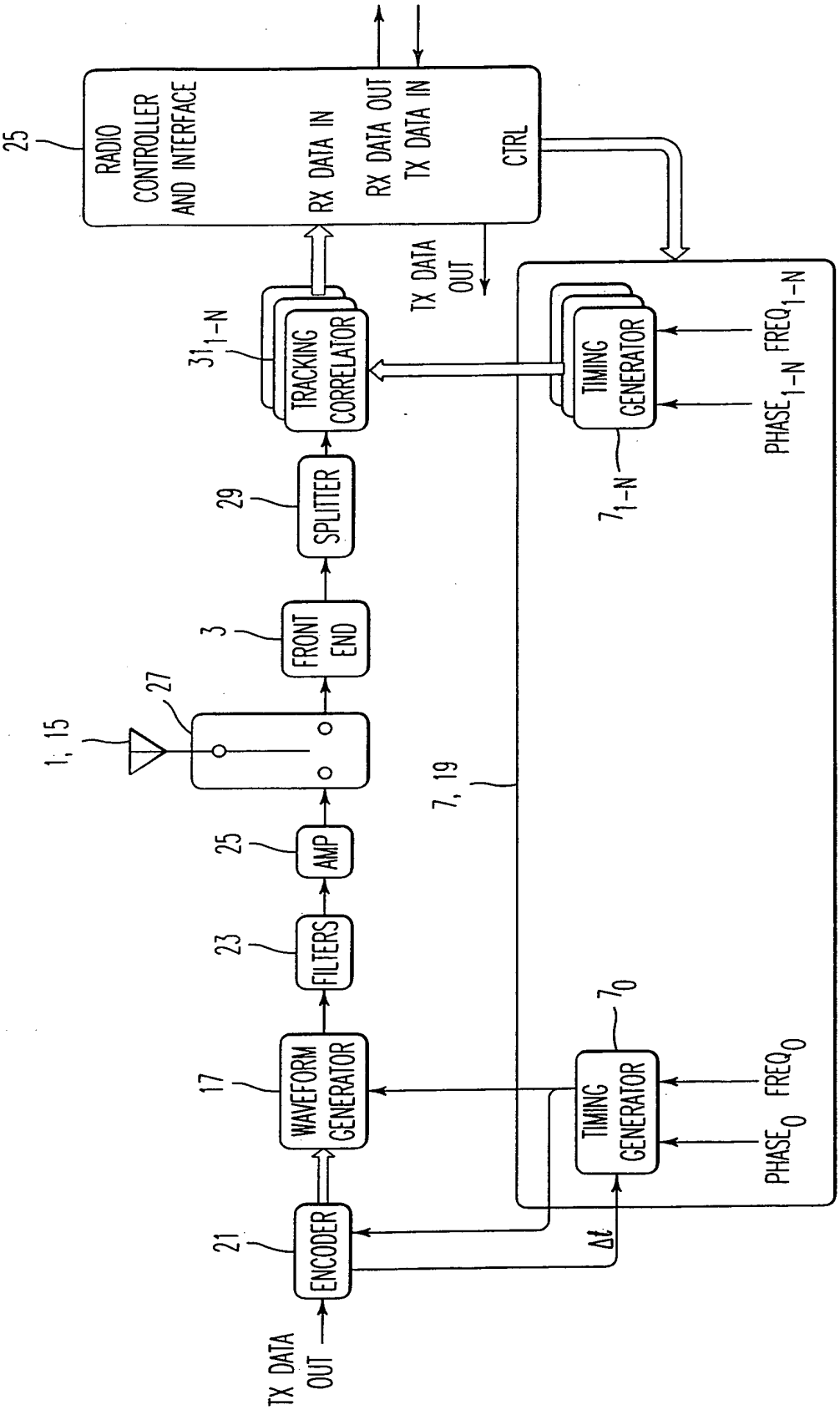

25
RADIO CONTROLLER AND INTERFACE
RX DATA IN
RX DATA OUT
TX DATA IN
CTRL
TX DATA OUT
31 1-N
TRACKING CORRELATOR
TIMING GENERATOR
PHASE 1-N
FREQ 1-N
7 1-N
29
SPLITTER
3
FRONT END
1, 15
27
7, 19
25
AMP
23
FILTERS
17
WAVEFORM GENERATOR
7 0
TIMING GENERATOR
PHASE 0
FREQ 0
21
ENCODER
Δt
TX DATA OUT

FIG. 2

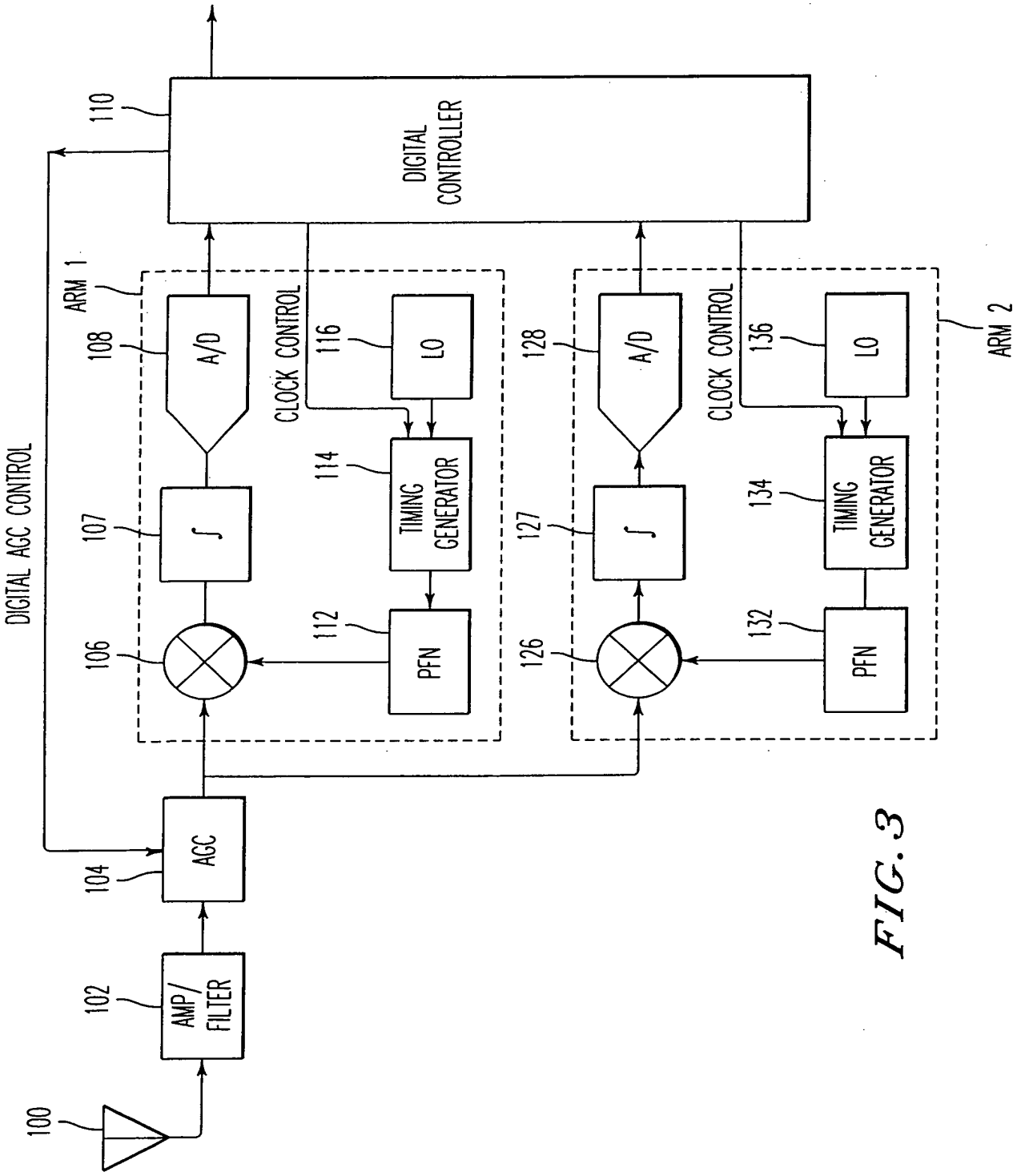

100
AMP/ FILTER
102
AGC
104
DIGITAL AGC CONTROL
ARM 1
106
107
A/D
108
CLOCK CONTROL
PFN
112
TIMING GENERATOR
114
LO
116
DIGITAL CONTROLLER
110
ARM 2
126
127
A/D
128
CLOCK CONTROL
PFN
132
TIMING GENERATOR
134
LO
136

FIG. 3

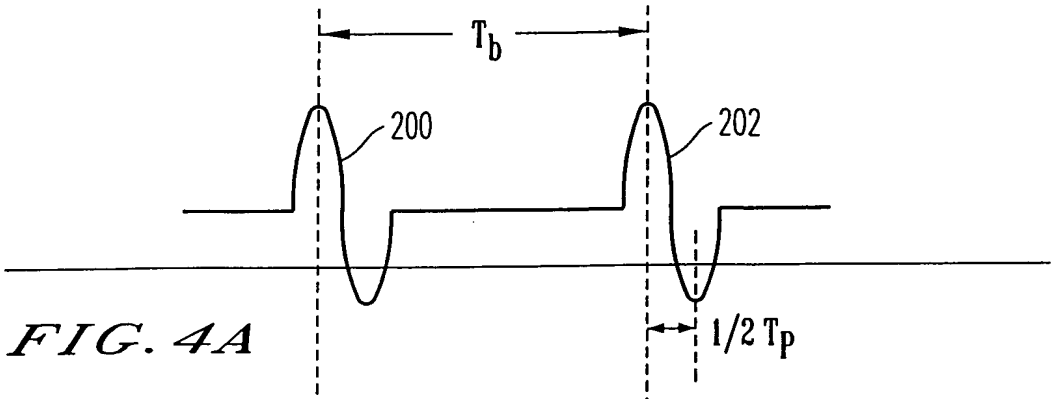


FIG. 4A

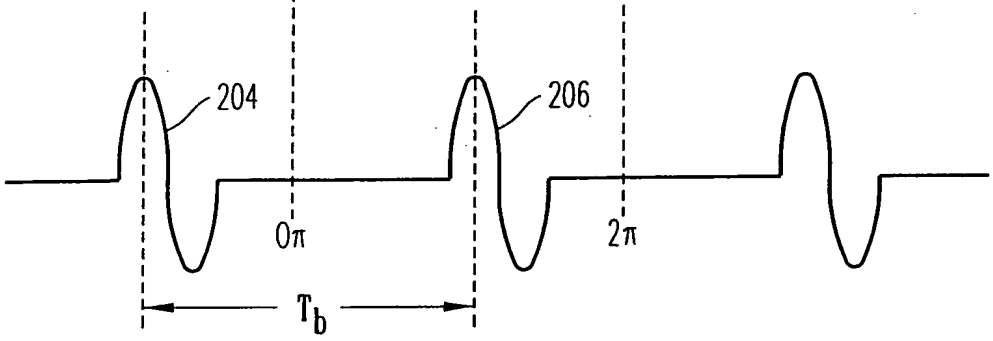


FIG. 4B

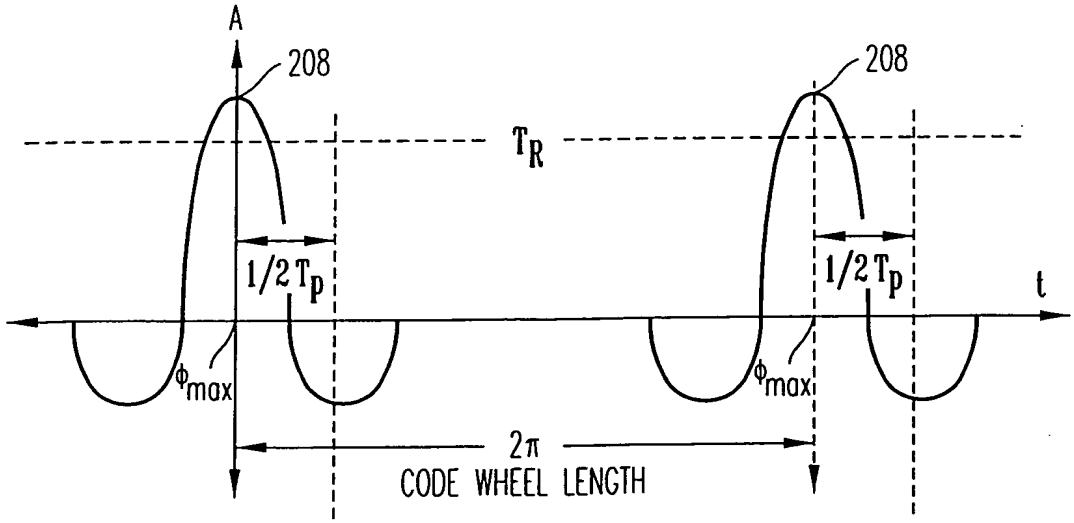


FIG. 4C

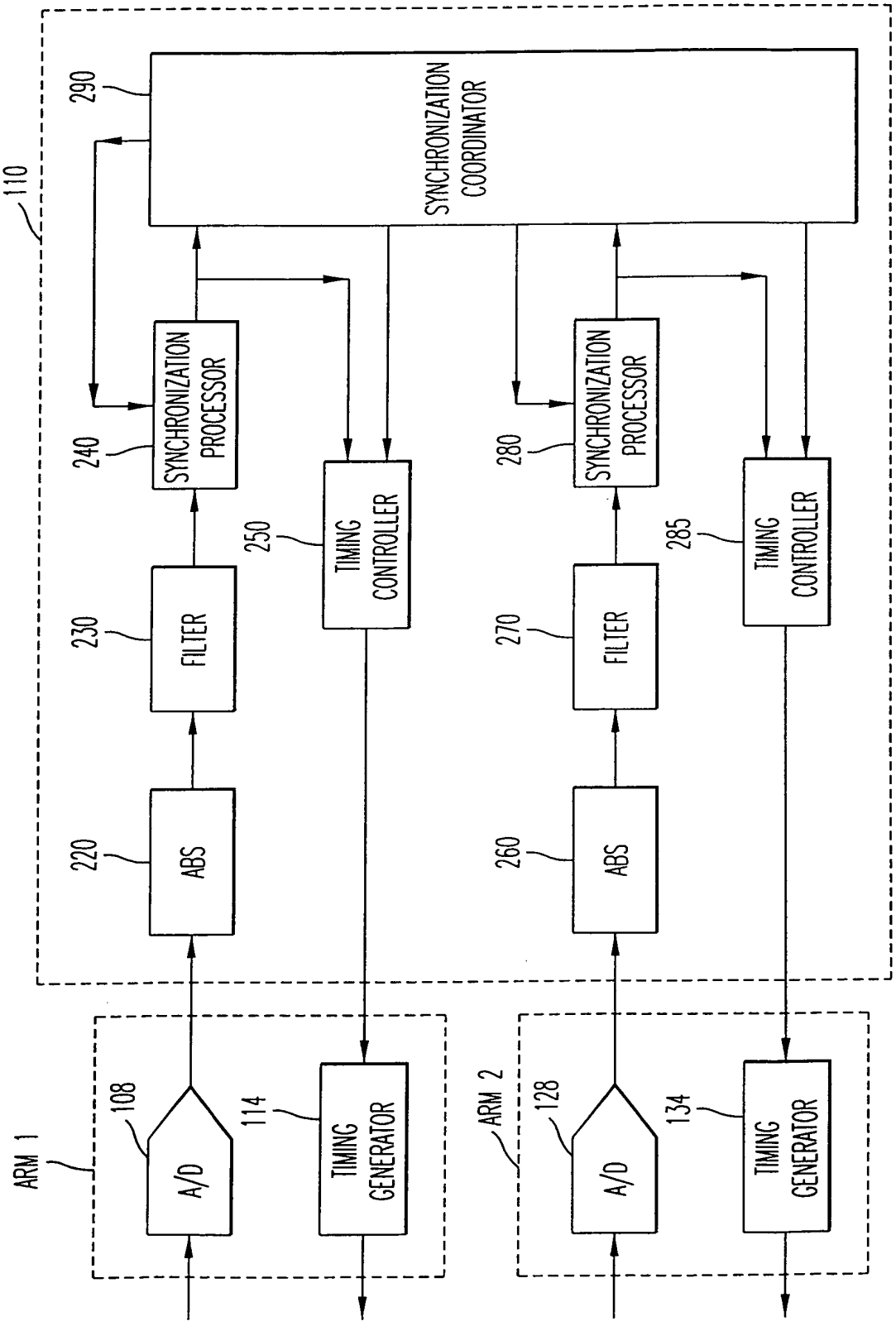

110
290
SYNCHRONIZATION COORDINATOR
240
SYNCHRONIZATION PROCESSOR
280
SYNCHRONIZATION PROCESSOR
250
TIMING CONTROLLER
285
TIMING CONTROLLER
230
FILTER
270
FILTER
220
ABS
260
ABS
ARM 1
108
A/D
114
TIMING GENERATOR
ARM 2
128
A/D
134
TIMING GENERATOR

FIG. 4D

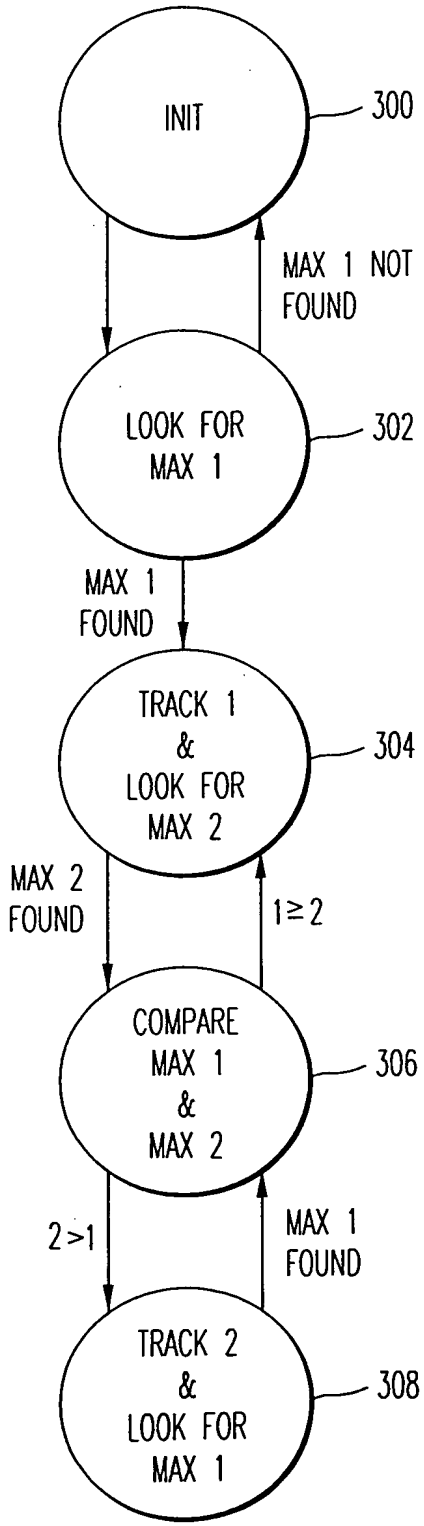

INIT
300
MAX 1 NOT FOUND
LOOK FOR MAX 1
302
MAX 1 FOUND
TRACK 1 & LOOK FOR MAX 2
304
MAX 2 FOUND
1≥2
COMPARE MAX 1 & MAX 2
306
2>1
MAX 1 FOUND
TRACK 2 & LOOK FOR MAX 1
308

FIG. 5

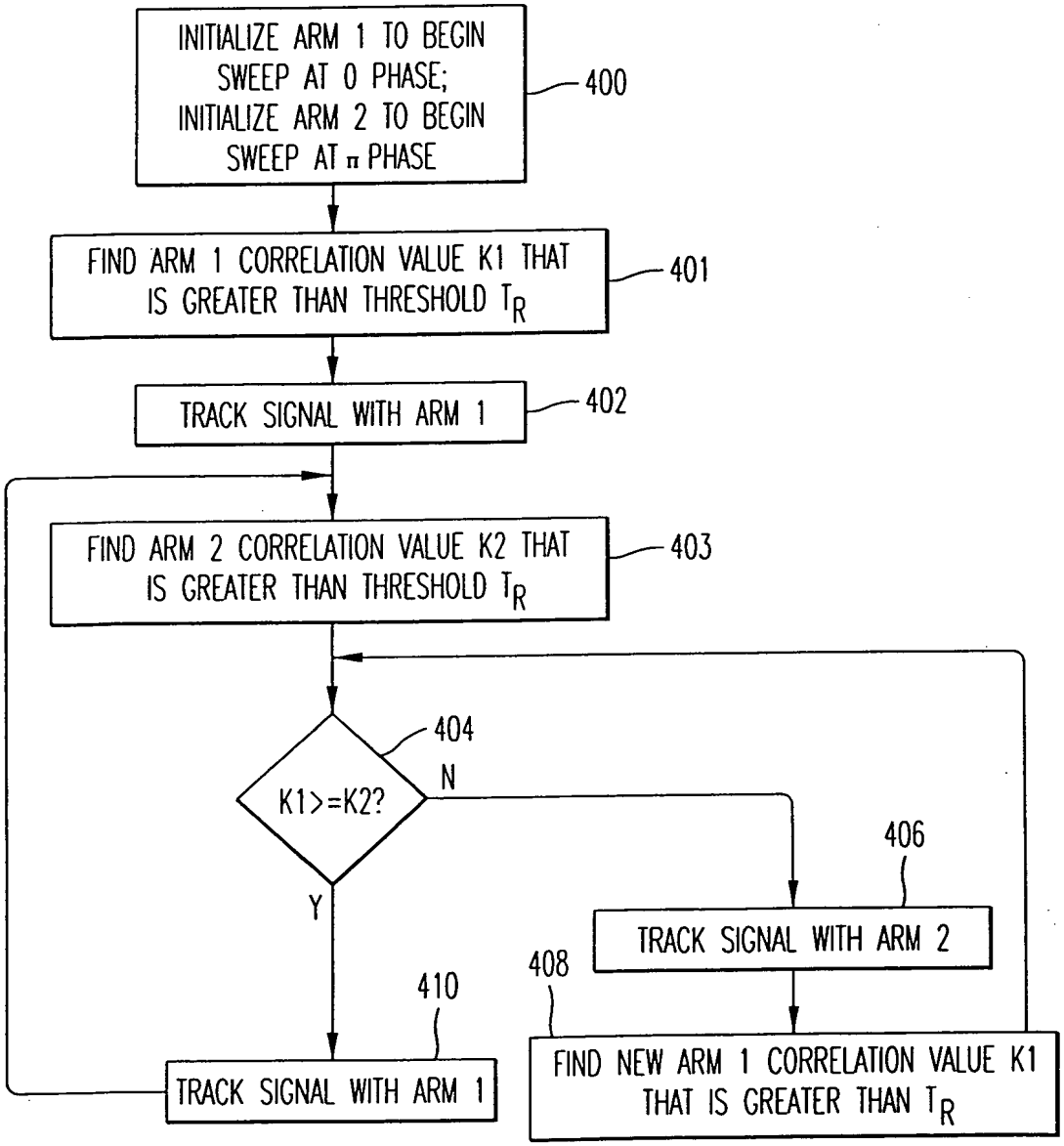

INITIALIZE ARM 1 TO BEGIN SWEEP AT 0 PHASE; INITIALIZE ARM 2 TO BEGIN SWEEP AT π PHASE
400
FIND ARM 1 CORRELATION VALUE K1 THAT IS GREATER THAN THRESHOLD T_R
401
TRACK SIGNAL WITH ARM 1
402
FIND ARM 2 CORRELATION VALUE K2 THAT IS GREATER THAN THRESHOLD T_R
403
404
K1>=K2?
N
Y
406
TRACK SIGNAL WITH ARM 2
408
410
TRACK SIGNAL WITH ARM 1
FIND NEW ARM 1 CORRELATION VALUE K1 THAT IS GREATER THAN T_R

FIG. 6

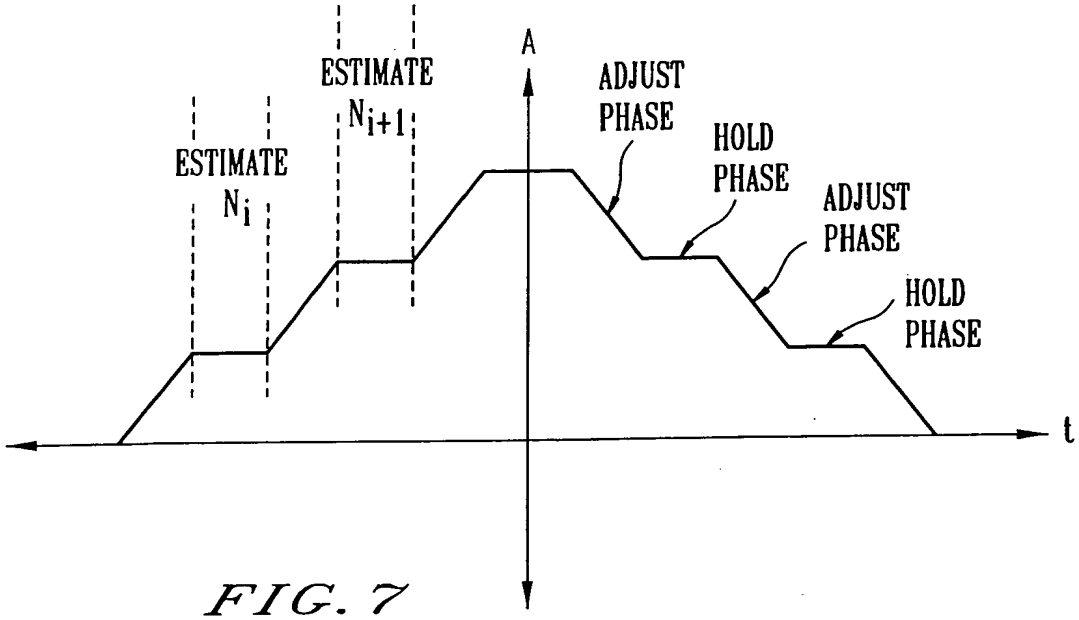

A
ESTIMATE
N_i
ESTIMATE
N_{i+1}
ADJUST
PHASE
HOLD
PHASE
ADJUST
PHASE
HOLD
PHASE
t

FIG. 7

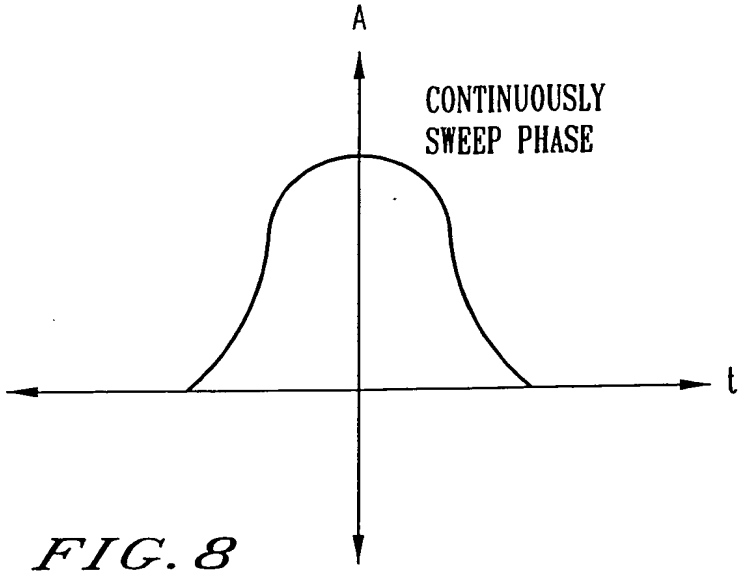

A
CONTINUOUSLY
SWEEP PHASE
t

FIG. 8

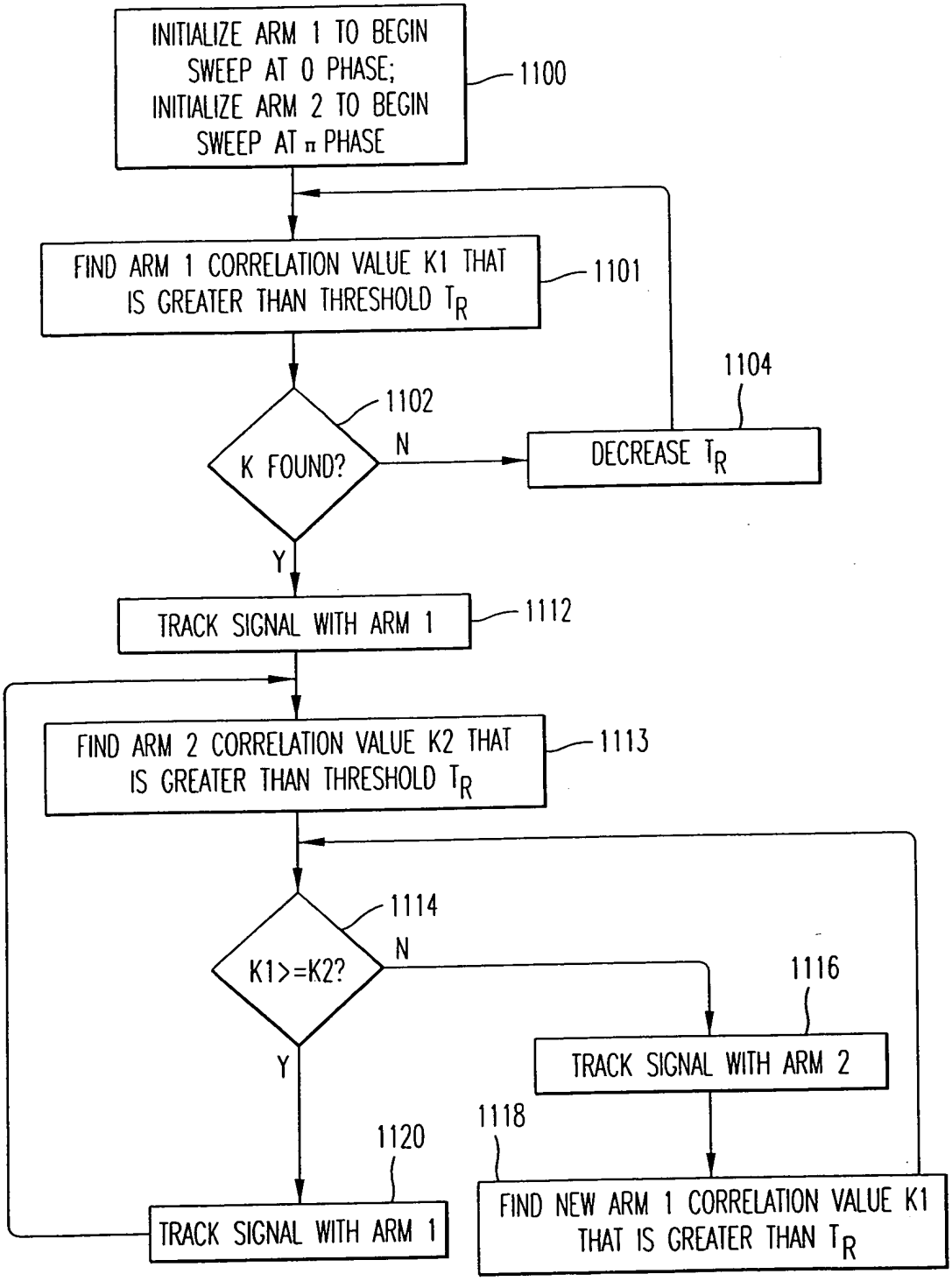

INITIALIZE ARM 1 TO BEGIN SWEEP AT 0 PHASE; INITIALIZE ARM 2 TO BEGIN SWEEP AT π PHASE
1100
FIND ARM 1 CORRELATION VALUE K1 THAT IS GREATER THAN THRESHOLD T_R
1101
K FOUND?
1102
N
DECREASE T_R
1104
Y
TRACK SIGNAL WITH ARM 1
1112
FIND ARM 2 CORRELATION VALUE K2 THAT IS GREATER THAN THRESHOLD T_R
1113
K1>=K2?
1114
N
TRACK SIGNAL WITH ARM 2
1116
Y
TRACK SIGNAL WITH ARM 1
1120
FIND NEW ARM 1 CORRELATION VALUE K1 THAT IS GREATER THAN T_R
1118

FIG. 9

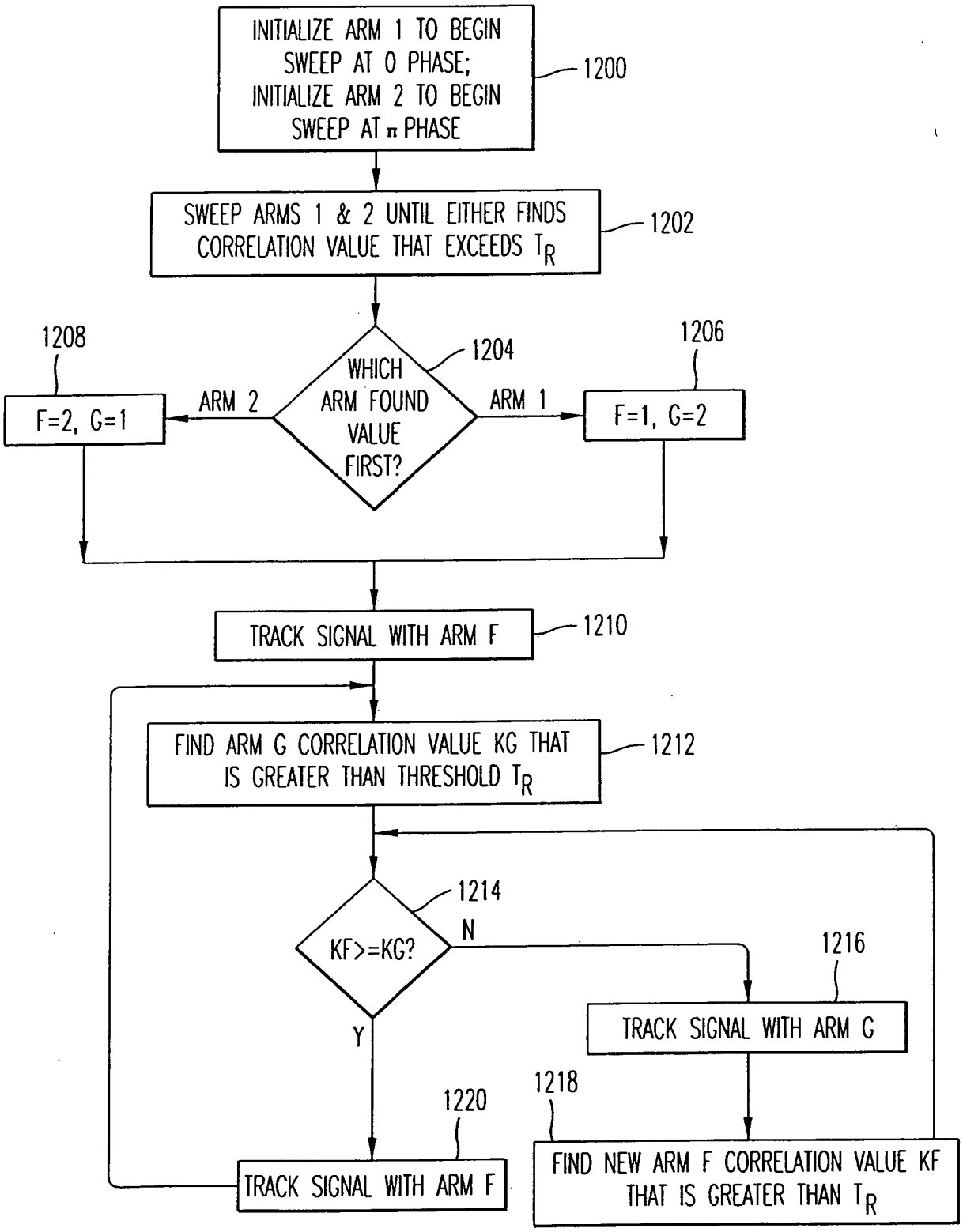

INITIALIZE ARM 1 TO BEGIN SWEEP AT 0 PHASE; INITIALIZE ARM 2 TO BEGIN SWEEP AT π PHASE
1200
SWEEP ARMS 1 & 2 UNTIL EITHER FINDS CORRELATION VALUE THAT EXCEEDS T_R
1202
WHICH ARM FOUND VALUE FIRST?
1204
ARM 2
ARM 1
1208
F=2, G=1
1206
F=1, G=2
TRACK SIGNAL WITH ARM F
1210
FIND ARM G CORRELATION VALUE KG THAT IS GREATER THAN THRESHOLD T_R
1212
KF>=KG?
1214
N
Y
1216
TRACK SIGNAL WITH ARM G
1218
1220
TRACK SIGNAL WITH ARM F
FIND NEW ARM F CORRELATION VALUE KF THAT IS GREATER THAN T_R

FIG. 10

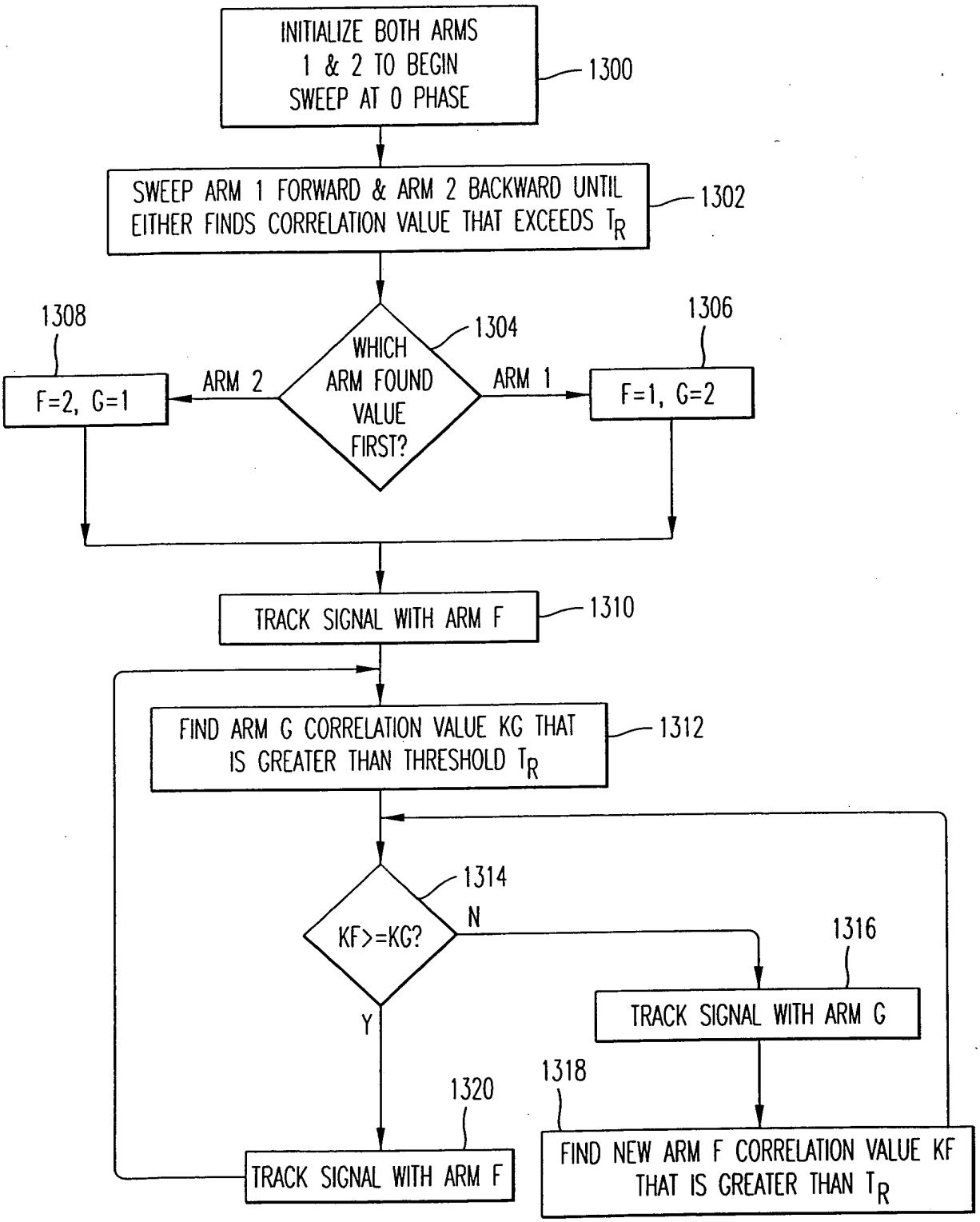

INITIALIZE BOTH ARMS 1 & 2 TO BEGIN SWEEP AT 0 PHASE
1300
SWEEP ARM 1 FORWARD & ARM 2 BACKWARD UNTIL EITHER FINDS CORRELATION VALUE THAT EXCEEDS T_R
1302
WHICH ARM FOUND VALUE FIRST?
1304
ARM 2
ARM 1
1308
F=2, G=1
1306
F=1, G=2
TRACK SIGNAL WITH ARM F
1310
FIND ARM G CORRELATION VALUE KG THAT IS GREATER THAN THRESHOLD T_R
1312
KF>=KG?
1314
N
Y
1316
TRACK SIGNAL WITH ARM G
1318
1320
TRACK SIGNAL WITH ARM F
FIND NEW ARM F CORRELATION VALUE KF THAT IS GREATER THAN T_R

FIG. 11

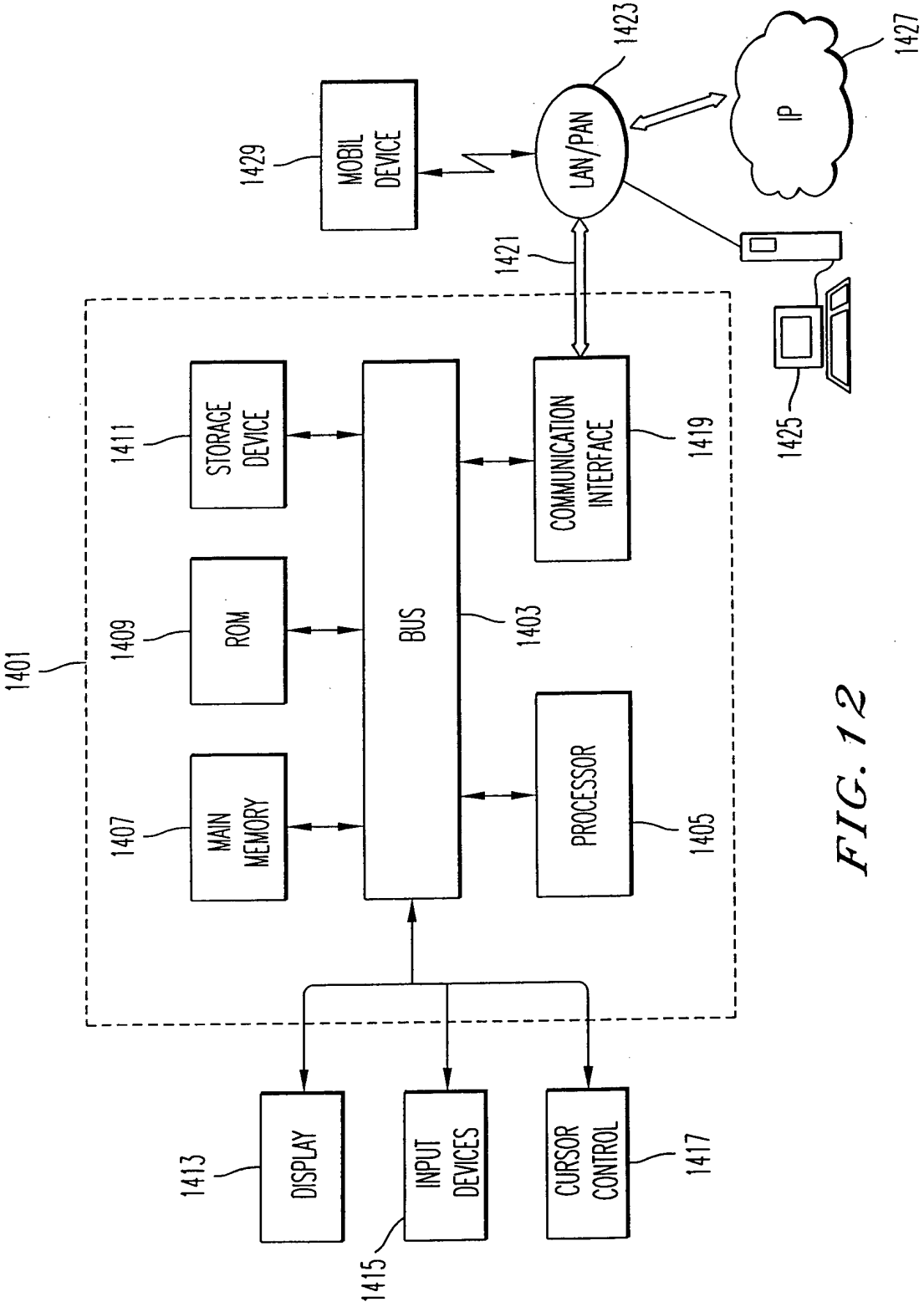

1401
1403
1405
1407
1409
1411
1413
1415
1417
1419
1421
1423
1425
1427
1429
BUS
PROCESSOR
MAIN MEMORY
ROM
STORAGE DEVICE
DISPLAY
INPUT DEVICES
CURSOR CONTROL
COMMUNICATION INTERFACE
LAN/PAN
IP
MOBIL DEVICE

FIG. 12

FIG. 13A

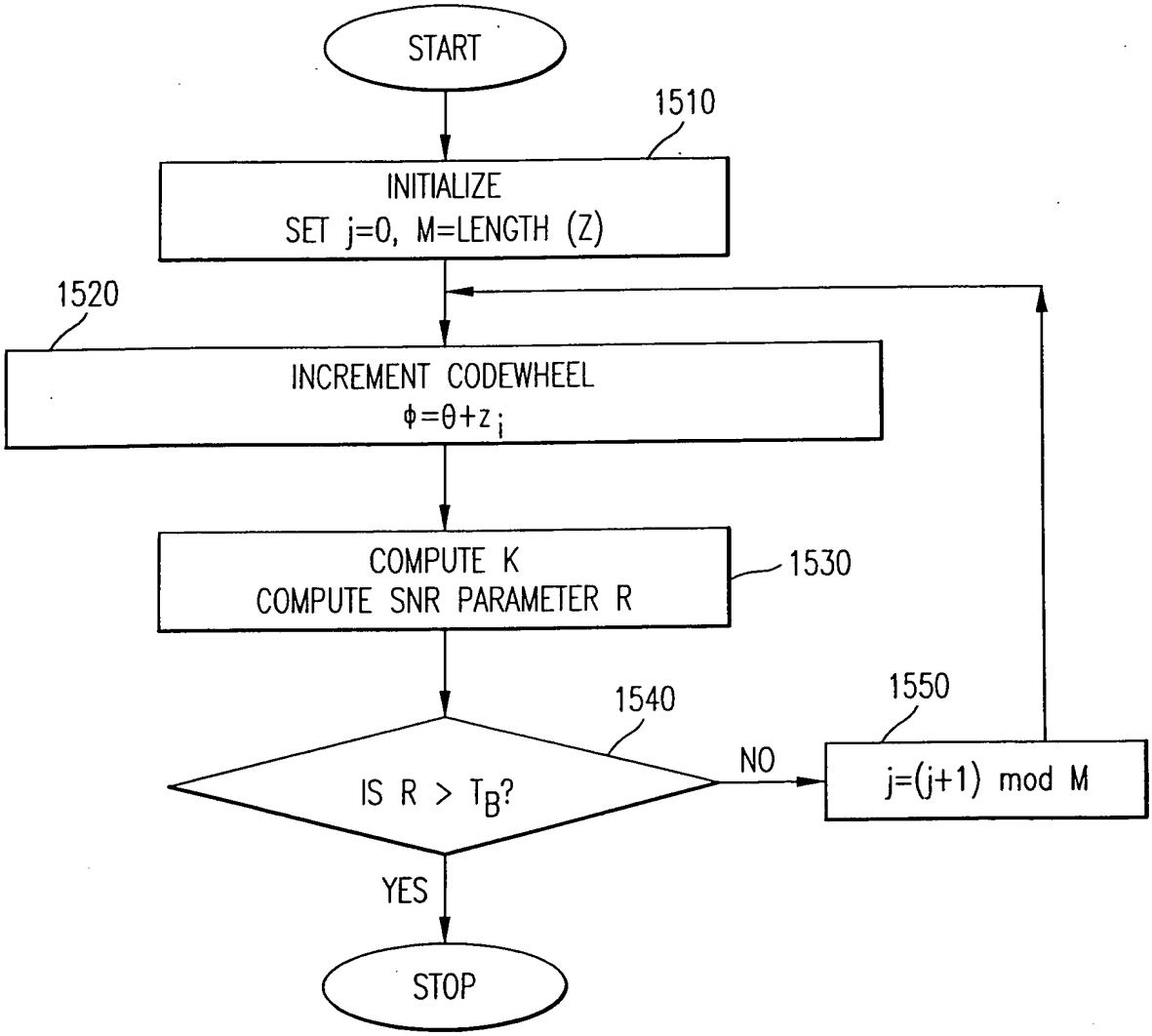

START
1510
INITIALIZE
SET j=0, M=LENGTH (Z)
1520
INCREMENT CODEWHEEL
$\phi=\theta+z_j$
COMPUTE K
COMPUTE SNR PARAMETER R
1530
1540
IS R > T_B?
NO
1550
j=(j+1) mod M
YES
STOP

FIG. 13B

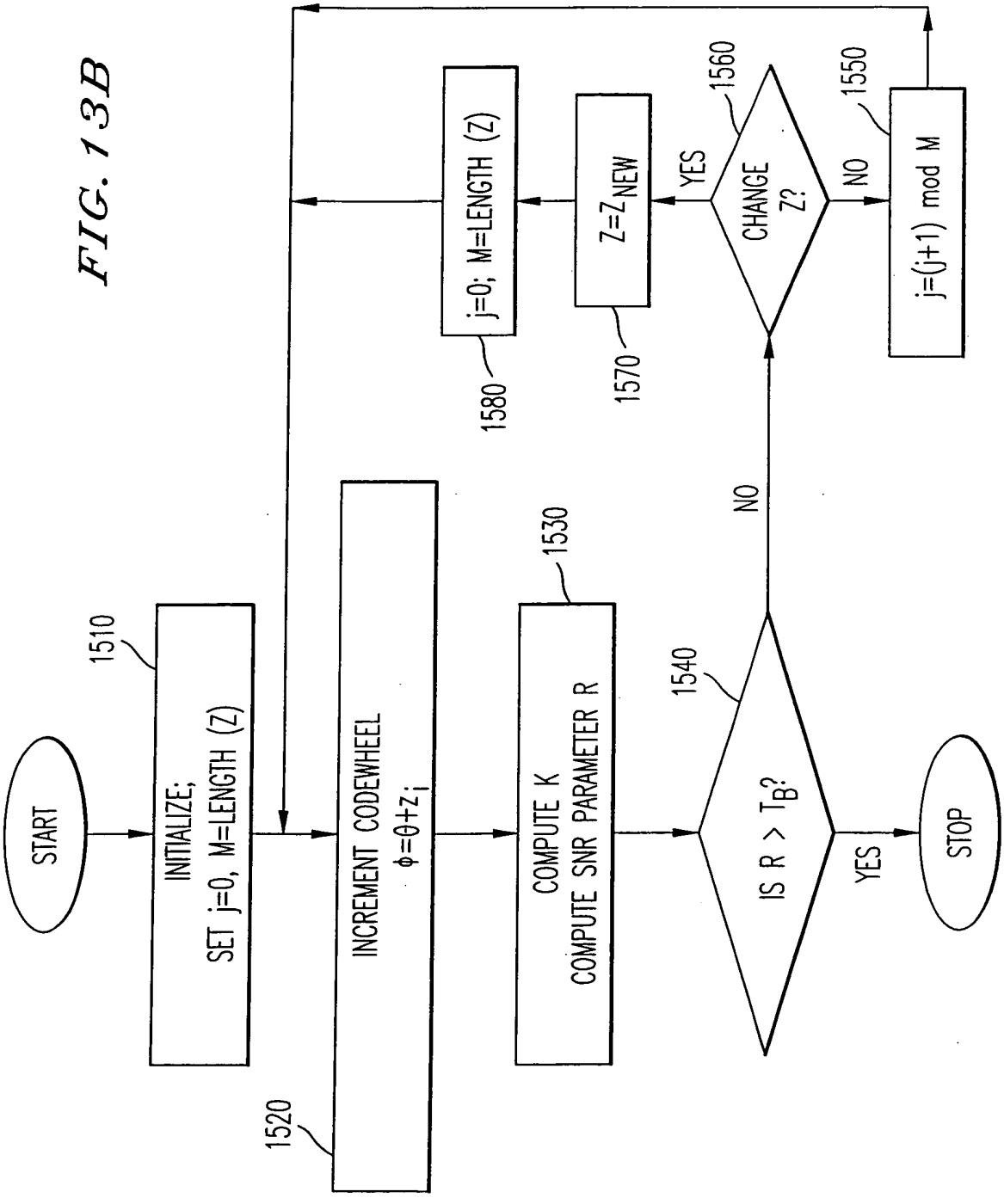

START
INITIALIZE;
SET j=0, M=LENGTH (Z)
1510
INCREMENT CODEWHEEL
$\phi=\theta+z_i$
1520
COMPUTE K
COMPUTE SNR PARAMETER R
1530
IS R > T_B?
1540
NO
YES
STOP
CHANGE Z?
1560
YES
NO
$Z=Z_{NEW}$
1570
j=0; M=LENGTH (Z)
1580
j=(j+1) mod M
1550

FIG. 14A

Z1={0, n, 2n, 3n,....,Q−3, Q−2, Q−1}.

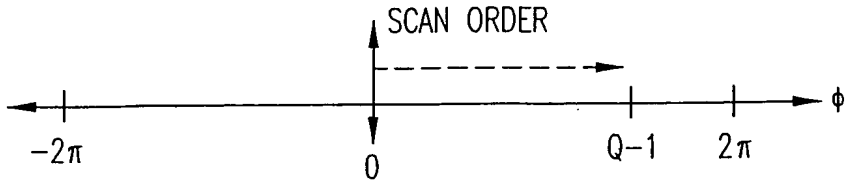


FIG. 14B

Z2 (FIRST EXAMPLE)=n*{[0,m−1], [−1,−2m], [m,5m−1], [−2m−1,−10m],...,(Q−1)/n}.

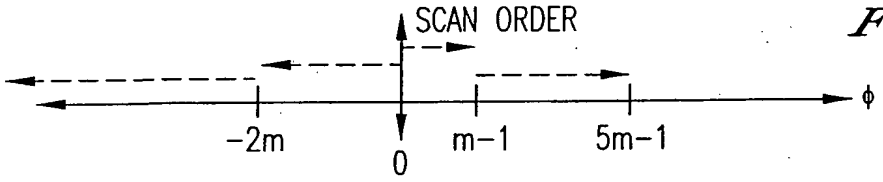


FIG. 14C

Z2 (SECOND EXAMPLE)={0,n,2n,...,(m−1)*n,−n,−2n,...,−m*n,m*n,(m+1)*n,(m+2)*n,...,(Q−1)}.

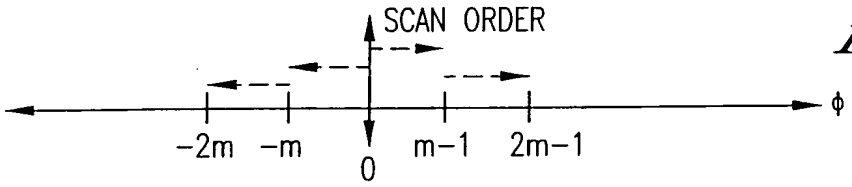
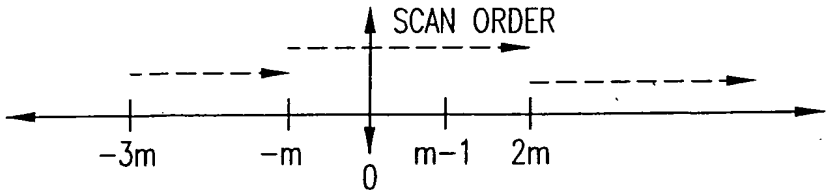


FIG. 14D

Z2 (THIRD EXAMPLE)={−m*n,(−m+1)*n,(−m+2)*n,...,−n,0,n,...,m*n,(m+1)*n,(m+2)*n,...2m*n, (−3m)*n,(−3m+1)*n,(−3m+2)*n,...,(−m−1)*n,(2m+1)*n,(2m+2)*n,...,(Q−1)}.



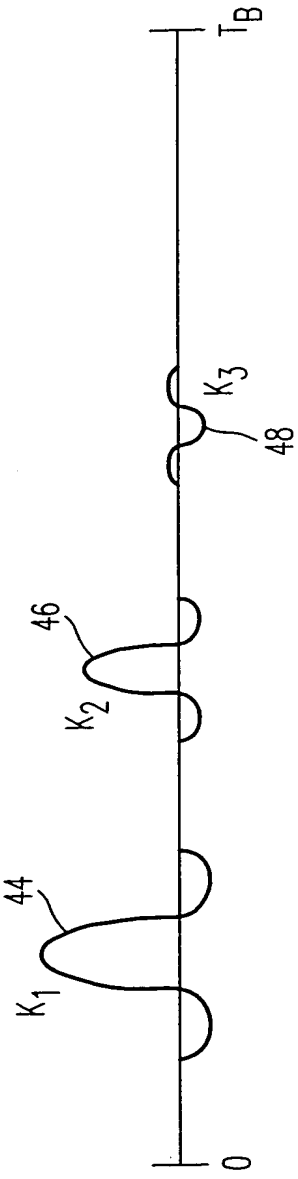
WHERE FOR FIGS. 14A, 14B, 14C, AND 14D:

Q=TOTAL NUMBER OF CODEWHEEL INCREMENTS IN EACH CODEWHEEL SPIN.THE MAXIMUM CODEWHEEL SPIN IS A COMPLETE (2π) CODEWHEEL SPIN, BUT OTHER CODEWHEEL SPINS ARE AVAILABLE;

n=AN ARBITRAY LOCAL PARAMETER THAT CONTROLS HOW FAST THE CODE WHEEL SPINS DEPENDING ON THE TIME INCREMENT STEP SIZE; AND

m=A NUMBER OF INCREMENTS LESS THAN THE TOTAL NUMBER OF INCREMENTS.

FIG. 15



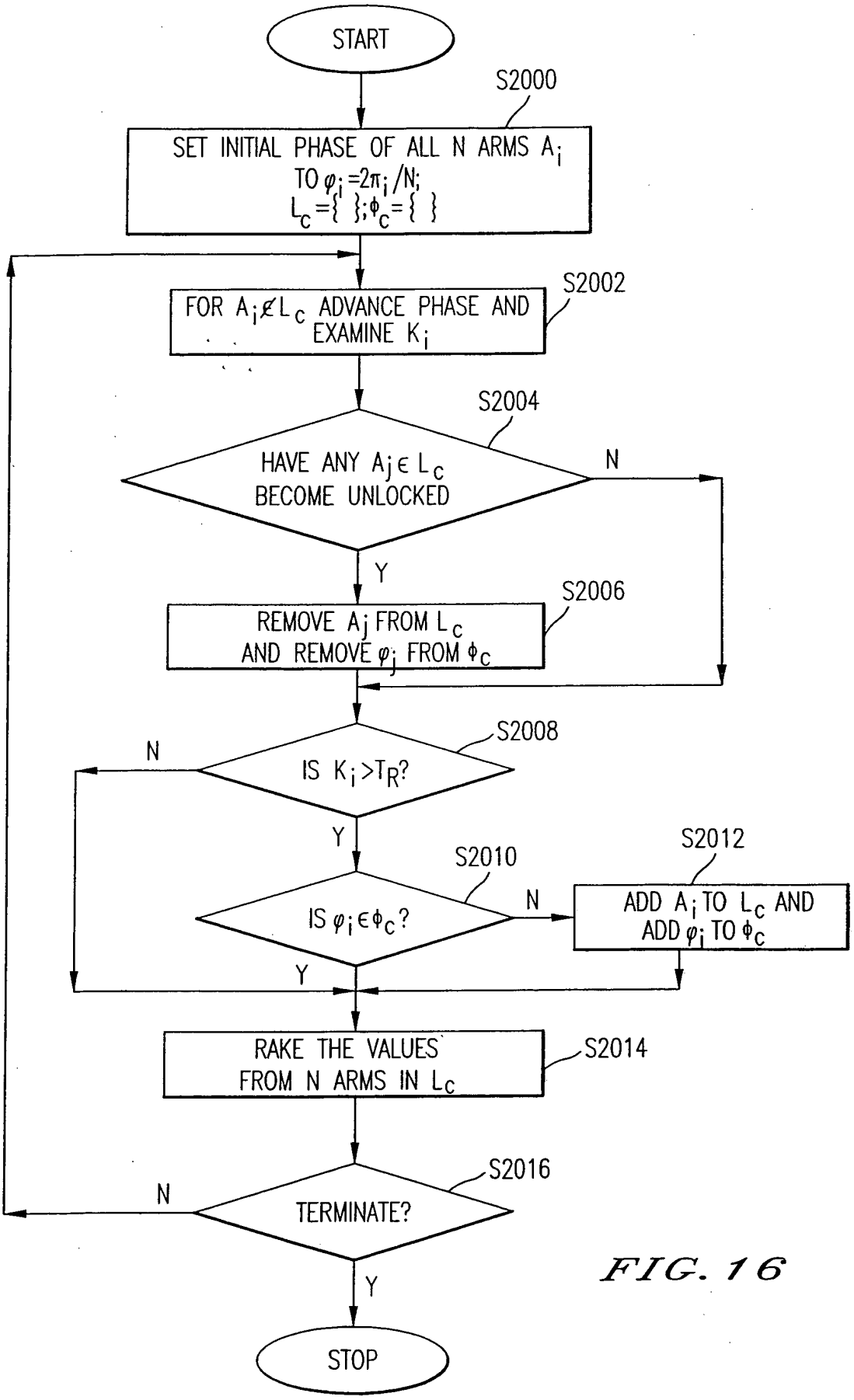

START
S2000
SET INITIAL PHASE OF ALL N ARMS A_i TO $\varphi_i = 2\pi_i / N$; $L_c = \{\}; \phi_c = \{\}$
S2002
FOR $A_i \notin L_c$ ADVANCE PHASE AND EXAMINE K_i
S2004
HAVE ANY $A_j \in L_c$ BECOME UNLOCKED
N
Y
S2006
REMOVE A_j FROM L_c AND REMOVE φ_j FROM ϕ_c
S2008
IS $K_i > T_R$?
N
Y
S2010
IS $\varphi_i \in \phi_c$?
N
S2012
ADD A_i TO L_c AND ADD φ_i TO ϕ_c
Y
RAKE THE VALUES FROM N ARMS IN L_c
S2014
S2016
TERMINATE?
N
Y
STOP

FIG. 16

FIG. 17A

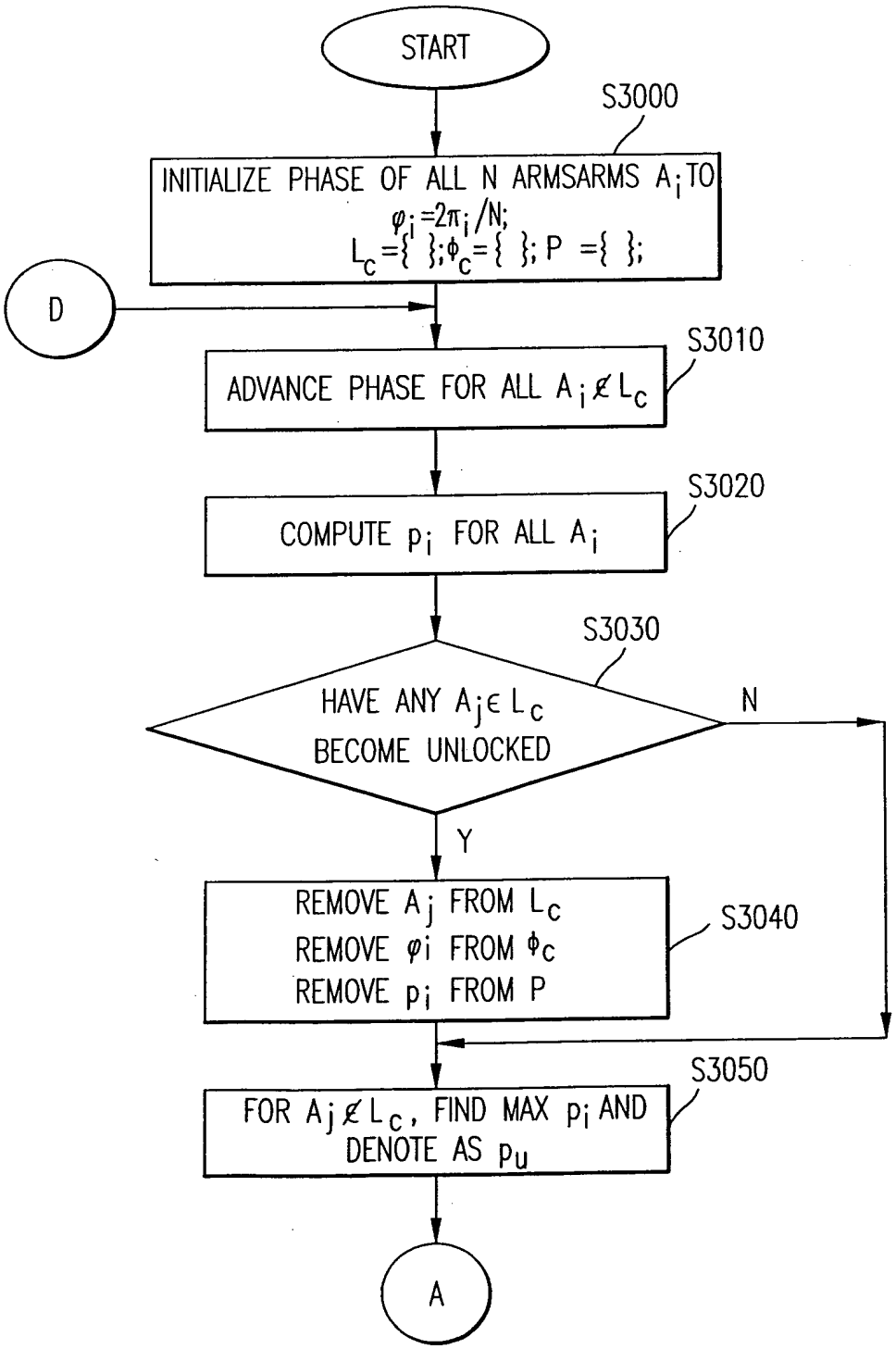

START
S3000
INITIALIZE PHASE OF ALL N ARMSARMS A_i TO $\varphi_i = 2\pi_i / N$; $L_c = \{\}; \phi_c = \{\}; P = \{\}$;
D
S3010
ADVANCE PHASE FOR ALL $A_i \notin L_c$
S3020
COMPUTE p_i FOR ALL A_i
S3030
HAVE ANY $A_j \in L_c$ BECOME UNLOCKED
N
Y
REMOVE A_j FROM L_c
REMOVE φi FROM ϕ_c
REMOVE p_i FROM P
S3040
S3050
FOR $A_j \notin L_c$, FIND MAX p_i AND DENOTE AS p_u
A

FIG. 17B

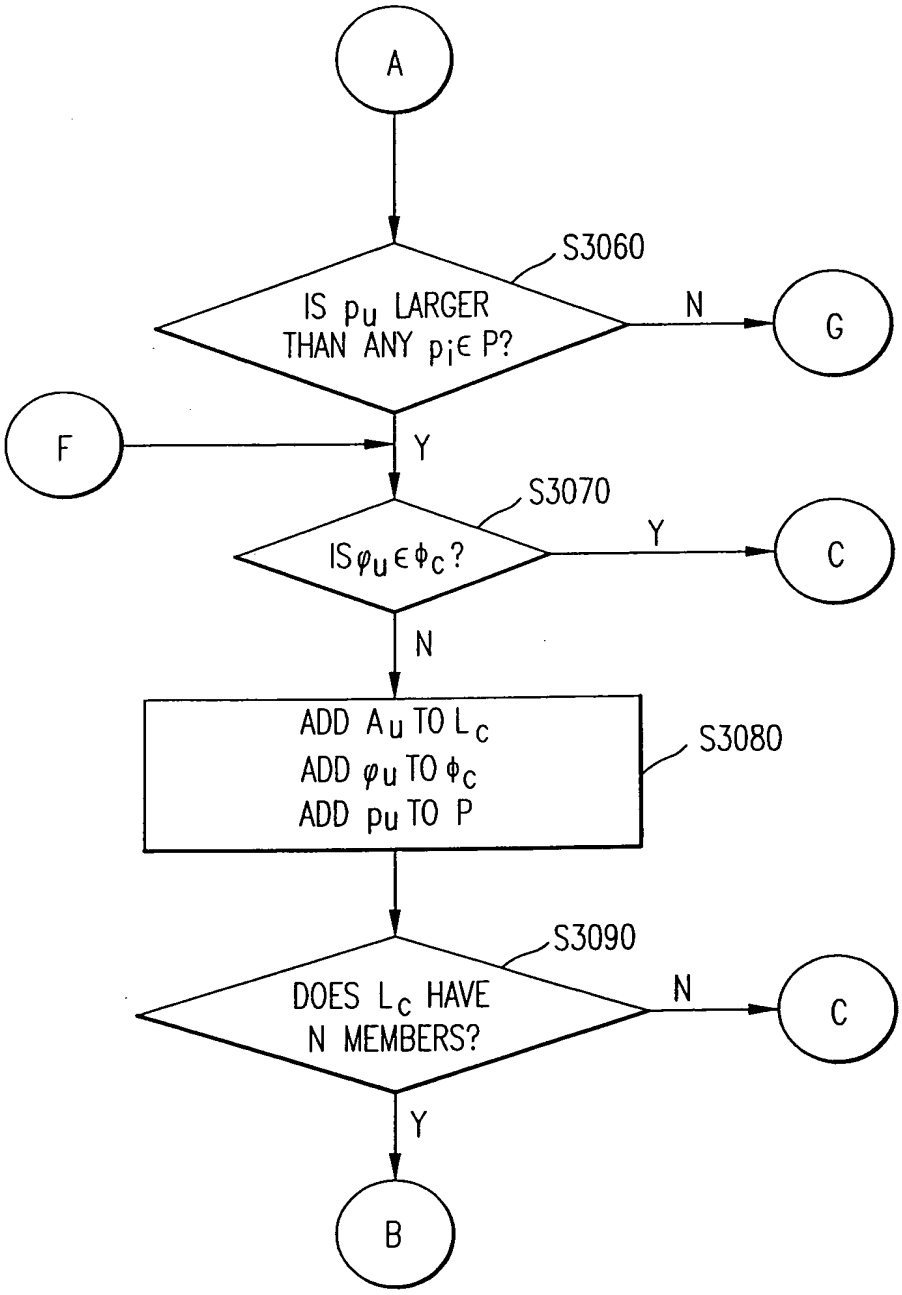
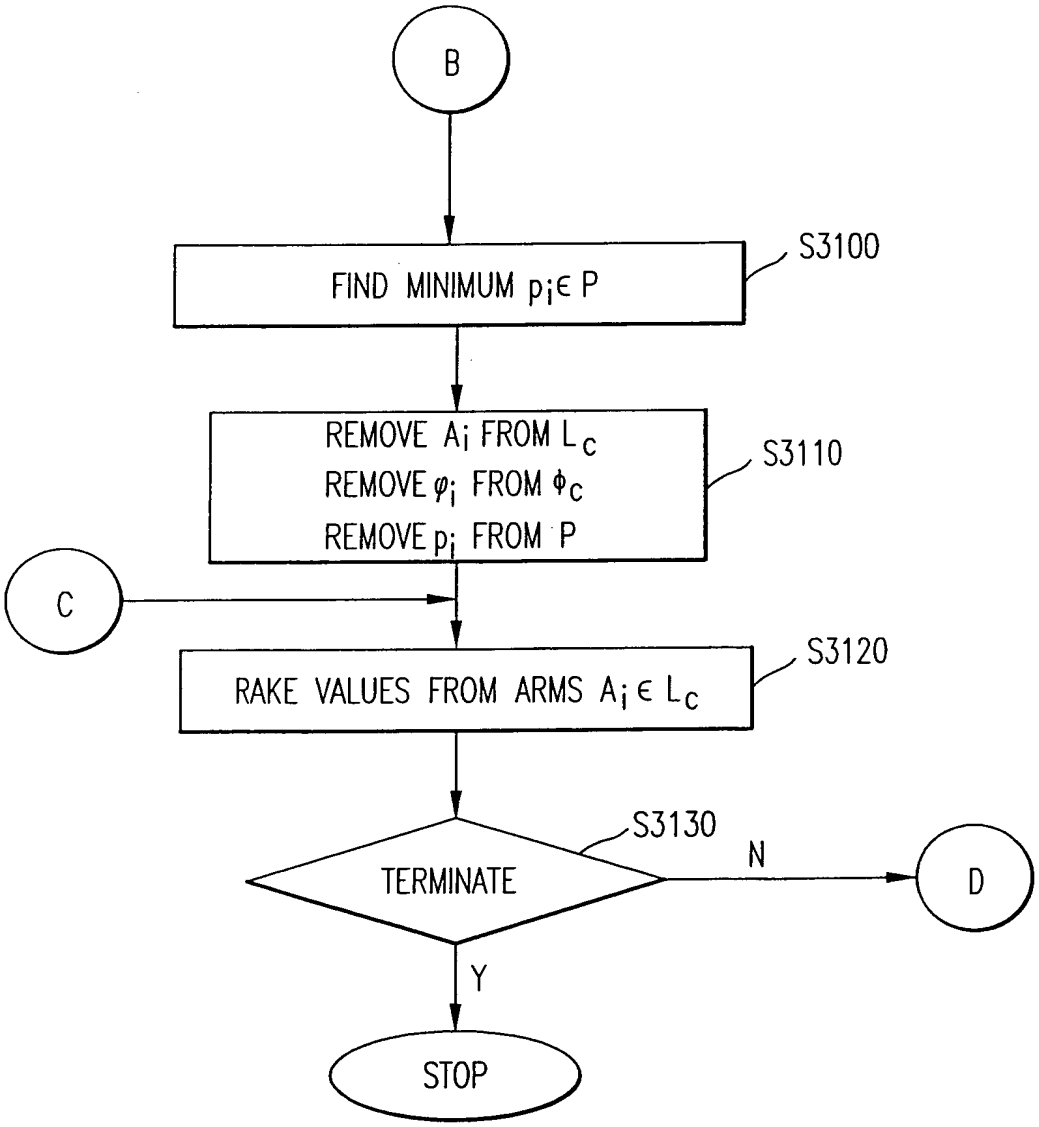

A
S3060
IS p_u LARGER THAN ANY $p_i \in P$?
N
G
F
Y
S3070
IS $\varphi_u \in \phi_c$?
Y
C
N
ADD A_u TO L_c
ADD φ_u TO ϕ_c
ADD p_u TO P
S3080
S3090
DOES L_c HAVE N MEMBERS?
N
C
Y
B

FIG. 17C


B
FIND MINIMUM $p_i \in P$
S3100
REMOVE A_i FROM L_c
REMOVE φ_i FROM Φ_c
REMOVE p_i FROM P
S3110
C
RAKE VALUES FROM ARMS $A_i \in L_c$
S3120
TERMINATE
S3130
N
D
Y
STOP

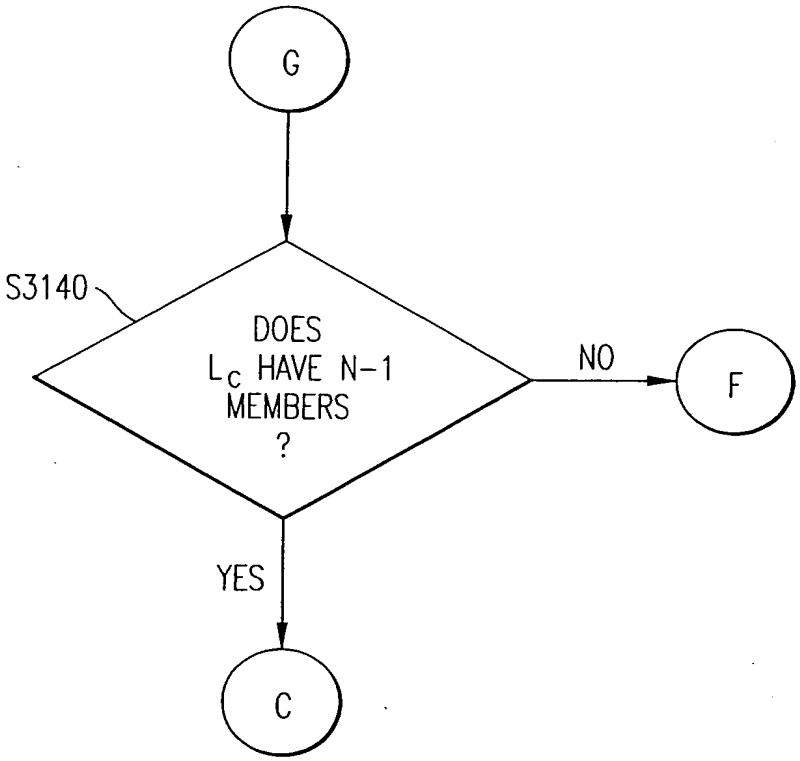



FIG. 17D